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Agricultural Memorandum No. 261

Formulae for Mean Return to Soil Capacity Dates

An attempt was made to find approximate formulae for the mean return to capacity dates using annual rainfall and current soil moisture deficit data.

Reasonable results were found within the ranges:-

Annual rainfall 20-36 in.
Soil Moisture Deficit below the maximum of 5 in, namely $\begin{pmatrix} R \\ D_x \end{pmatrix}$

1. End of August Deficits

Number of days after August 31 = $88 - 2.6R + 18D_A$

2. End of September Deficits

Number of days after September 30 = $66 - 2R + 13.6D_S$

3. End of October Deficits

Number of days after October 31 = $35 - 1.1R + 12D_O$

It is only to be expected that the higher rainfall areas do not fit conveniently into an empirical linear pattern, but the divergence of dates following occasions when the presumed maximum of 5 in. soil moisture is less easily explained. It may be that after a very dry summer there is a tendency towards earlier autumn rains than after a moderately dry series of months.

For the 20-36 in. annual rainfall range, the closest fits for return dates following the 5 in. maximum deficit are

4. Number of days after August 31 = $211 - 4.4R$

5. Number of days after September 30 = $141 - 2.6R$

6. Number of days after October 31 = $227 - 6R$ (a poor fit).

Details of the mean dates to which these formulae were fitted are given in the Appendix, together with the standard deviations (in 10-day units).

Any comments or criticism on the memorandum should be sent to the author.

L.P. Smith
Meteorological Office
Bracknell, Berks. RG12 2SZ

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Appendix

Mean Dates

August Deficits (in)	Average Annual Rainfall (in)										
	21	23	25	27	29	31	33	35	38	Over 40
0-1	Oct 3	Oct 9	Oct 9	Sept 21	Sept 23	Sept 10	Sept 10	Sept 7	Sept 10	Sept12
1-2	Oct 18	Oct 25	Oct 17	Oct 14	Oct 6	Oct 13	Oct 1	Oct 2	Oct 10	Sept27
2-3	Nov 22	Nov 24	Nov 13	Oct 31	Nov 2	Oct 19	Oct 21	Oct 9	Oct 15	Oct 18
3-4	Dec 22	Dec 1	Nov 27	Nov 23	Nov 13	Nov 10	Nov 7	Nov 4	Oct 22	Oct 28
4-5	Dec 25	Dec 13	Dec 9	Dec 7	Nov 28	Nov 21	Nov 24	Nov 15	Nov 9	Oct 25
5	Dec 25	Dec 30	Dec 17	Nov 22	Nov 9	Nov 13	Nov 5	Nov 6	Nov 15	-
September Deficits (in)										
0-1	Oct 10	Oct 22	Oct 19	Oct 14	Oct 16	Oct 10	Oct 9	Oct 9	Oct 13	-
1-2	Nov 14	Nov 8	Nov 6	Nov 6	Nov 5	Oct 28	Oct 23	Oct 26	Oct 20	Oct 17
2-3	Nov 28	Nov 24	Nov 19	Nov 17	Nov 14	Nov 5	Oct 4	Oct 28	Nov 10	Oct 25
3-4	Dec 10	Dec 7	Dec 3	Dec 2	Nov 20	Nov 21	Nov 22	Nov 11	Nov 6	Oct 25
4-5	Jan 4	Dec 25	Dec 19	Dec 14	Dec 2	Nov 1	Nov 22	Nov 13	Nov 19	Oct 30
5	Dec 29	Dec 24	Dec 17	Dec 5	Nov 26	Nov 26	Nov 20	Dec 2	Nov 15	-
October Deficits (in)										
0-1	Nov 12	Nov 12	Nov 10	Nov 11	Nov 13	Nov 8	Nov 10	Nov 6	Nov 7	Nov 5
1-2	Nov 25	Nov 27	Nov 26	Nov 25	Nov 23	Nov 20	Nov 15	Nov 14	Nov 13	Nov 5
2-3	Dec 15	Dec 10	Dec 9	Dec 9	Nov 26	Nov 27	Nov 29	Nov 29	Nov 24	-
3-4	Dec 28	Dec 22	Dec 21	Dec 16	Dec 12	Dec 8	Dec 3	Dec 2	-	-
4-5	Jan 14	Jan 6	Dec 25	Dec 23	Dec 25	Jan 3	Dec 13	Jan 5	-	-
5	Jan 19	Jan 19	Jan 14	Jan 13	Jan 5	Dec 25	-	-	-	-

Standard Deviations from Mean Dates (10-day units)

August Deficits	Average Annual Rainfall (in)								
	21	23	25	27	29	31	33	35	38
0-1	2.3	2.5	2.7	1.9	2.4	1.2	1.3	0.5	1.2
1-2	2.4	2.1	2.5	2.3	2.0	2.9	2.0	1.8	2.5
2-3	1.6	2.0	2.4	2.8	2.5	1.5	2.1	1.6	2.4
3-4	2.5	2.6	2.6	2.7	2.1	2.5	2.1	1.8	1.5
4-5	2.8	3.0	2.8	2.3	2.2	2.5	1.9	2.2	1.7
5	3.5	2.4	2.3	3.0	1.8	2.5	0.7	1.7	-
September Deficits									
0-1	-	1.6	1.5	1.1	1.2	1.3	0.8	1.1	1.2
1-2	1.0	1.7	1.3	1.3	1.5	0.9	1.3	1.2	1.2
2-3	1.5	1.4	2.0	1.8	1.5	1.9	1.5	1.3	1.6
3-4	2.1	2.0	2.1	2.2	2.1	2.1	1.8	2.4	1.4
4-5	3.2	2.7	2.7	2.5	2.4	2.6	1.9	1.6	1.7
5	3.2	2.7	2.3	2.4	2.0	2.1	1.4	2.1	-
October Deficits									
0-1	1.0	1.1	1.3	1.3	1.1	0.8	1.2	0.3	0.5
1-2	1.6	1.6	1.6	1.6	1.4	1.6	0.9	0.4	0.9
2-3	1.8	2.1	2.4	2.1	1.3	1.2	1.0	1.1	0.9
3-4	2.6	2.3	2.5	1.7	1.6	1.4	1.0	1.3	-
4-5	3.4	2.7	2.2	1.8	1.6	0.5	1.0	-	-
5	1.3	0.7	0.4	0.5	-	-	-	-	-